

WHAT IS CLAIMED IS:

1. A wafer polishing head for polishing a semiconductor wafer on a polishing pad, said polishing head comprising:

a housing including an upper housing portion;

5 a retaining ring having an interior cylindrical surface and defining an interior cylindrical pocket sized to carry said wafer and to laterally restrain movement of said wafer when said wafer is moved relative to said polishing pad while being polished against said polishing pad;

10 a wafer subcarrier attached to said retaining ring by a primary diaphragm and to said housing by a secondary diaphragm;

a resilient pneumatic annular sealing bladder coupled for fluid communication to a first pressurized pneumatic fluid to define a first pneumatic zone and attached to a first surface of said wafer stop plate adjacent said retaining ring interior cylindrical surface to receive said wafer and to support said wafer at a peripheral edge;

15 said resilient pneumatic annular sealing bladder defining a second pneumatic zone radially interior to said first pneumatic zone and extending between said first surface of said wafer stop plate and said wafer when said wafer is attached to said polishing head during a polishing operation and coupled for fluid communication to a second pressurized pneumatic fluid, said first surface of said wafer stop plate not being in contact with a  
20 wafer back side surface during polishing of said wafer;

said wafer attachment stop plate operative during non polishing periods to prevent said wafer from flexing excessively from an applied vacuum force used to hold said wafer to said polishing head during wafer loading and unloading operations;

25 said first and said pressurized fluids being adjusted to achieve a predetermined polishing pressures over a front side surface of said wafer.

2. In a polishing machine, a method of applying air pressure to a retaining ring, sub-carrier, pneumatic bladder, and back side of wafer separately.

30 3. In a polishing machine, a method of using a diaphragm supported from floating retaining ring.

4. In a polishing machine, a method of using an open diaphragm support from floating retaining ring.

5. A wafer polishing head for polishing a semiconductor wafer on a polishing pad, said polishing head comprising:

a retaining ring having an interior cylindrical surface and defining an interior cylindrical pocket sized to carry said wafer and to laterally restrain movement of said wafer when said wafer is moved relative to said polishing pad while being polished against said polishing pad;

a wafer attachment stop plate attached to said retaining ring;

a resilient pneumatic annular sealing bladder coupled for fluid communication to a first pressurized pneumatic fluid to define a first pneumatic zone and attached to a first surface of said wafer stop plate adjacent said retaining ring interior cylindrical surface to receive said wafer and to support said wafer at a peripheral edge;

said resilient pneumatic annular sealing bladder defining a second pneumatic zone radially interior to said first pneumatic zone and extending between said first surface of said wafer stop plate and said wafer when said wafer is attached to said polishing head during a polishing operation and coupled for fluid communication to a second pressurized pneumatic fluid, said first surface of said wafer stop plate not being in contact with a wafer back side surface during polishing of said wafer;

said wafer attachment stop plate operative during non polishing periods to prevent said wafer from flexing excessively from an applied vacuum force used to hold said wafer to said polishing head during wafer loading and unloading operations;

said first and said pressurized fluids being adjusted to achieve a predetermined polishing pressures over a front side surface of said wafer.

6. A wafer polishing head for polishing a semiconductor wafer on a polishing pad, said polishing head comprising:

a retaining ring having an interior cylindrical surface and defining an interior cylindrical pocket sized to carry said wafer and to laterally restrain movement of said wafer when said wafer is moved relative to said polishing pad while being polished against said polishing pad;

a wafer attachment stop plate attached to said retaining ring;

a resilient seal disposed adjacent said retaining ring interior cylindrical surface to receive said wafer and to support said wafer at a peripheral edge and defining a first pneumatic zone when said wafer has been mounted coupled for fluid communication to a first pressurized pneumatic fluid;

5        said wafer attachment stop plate operative during non polishing periods to prevent said wafer from flexing excessively from an applied vacuum force used to hold said wafer to said polishing head during wafer loading and unloading operations;

      said first and said pressurized fluids being adjusted to achieve a predetermined polishing pressures over a front side surface of said wafer.

10        7.        A wafer polishing head for polishing a semiconductor wafer on a polishing pad, said polishing head comprising:

      a retaining ring having an interior cylindrical surface and defining an interior cylindrical pocket sized to carry said wafer and to laterally restrain movement of said wafer when said wafer is moved relative to said polishing pad while being polished against said polishing pad;

      a wafer attachment stop plate attached to said retaining ring;

      a plurality of resilient pneumatic bladders attached to a first surface of said wafer stop plate, each said bladder being coupled for fluid communication to a source of pressurized pneumatic fluid;

20        a first one of said plurality of resilient pneumatic bladders having an annular shape and disposed adjacent said retaining ring interior cylindrical surface to receive said wafer and to support said wafer at a peripheral edge, said first bladder being coupled for fluid communication to a first pressurized pneumatic fluid;

25        a second one of said plurality of resilient pneumatic bladders disposed interior to said annular shaped first bladder and coupled for fluid communication to a second pressurized pneumatic fluid;

      said first and said pressurized fluids being adjusted to achieve a predetermined polishing pressures over a front side surface of said wafer.

30        8.        A wafer polishing head for polishing a semiconductor wafer on a polishing pad, said polishing head comprising:

a retaining ring having an interior cylindrical surface and defining an interior cylindrical pocket sized to carry said wafer and to laterally restrain movement of said wafer when said wafer is moved relative to said polishing pad while being polished against said polishing pad;

5 a wafer attachment stop plate attached to said retaining ring;

said wafer attachment stop plate having a plurality of resilient concentric annular sealing ridges extending from a surface of said stop plate and defining independent pneumatic zones when pressed against a back side surface of said wafer, each said pneumatic zone being coupled for fluid communication to a source of pressurized pneumatic fluid;

10 a first one of said plurality of resilient concentric annular sealing ridges being disposed adjacent said retaining ring interior cylindrical surface to receive said wafer and to support said wafer at a peripheral edge and defining a first pneumatic zone, said first pneumatic zone being coupled for fluid communication to a first pressurized pneumatic fluid;

15 a second one of said plurality of resilient concentric annular sealing ridges being disposed interior to said first annular sealing ridges and coupled for fluid communication to a second pressurized pneumatic fluid;

20 said first and said pressurized fluids being adjusted to achieve a predetermined polishing pressures over a front side surface of said wafer.

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